

The same observer discovered in grafts of twelve weeks' standing that the cutis was firmer and the cellular infiltration less, while the number of new connective-tissue cells in the normal skin was much increased.

Garré studied skin-grafts four to eighteen months old, and observed that the upper part of the preparation showed the normal loose connective tissue, in which the vessels passed to the summits of the papillæ. There was no cicatricial or dense tissue, as has been theoretically supposed. These observations correspond with those of Goldmann, who thus explains the absence of any tendency to cicatricial contraction in grafted skin.

Observation shows that sensibility returns to the grafted area usually from the periphery inward. Sometimes a return of sensibility is observed in small areas surrounded by an anæsthetic surface. A number of such sensitive islands would become larger and larger till finally by their confluence the whole surface became sensitive.

As a result of the observations which Goldmann has carried out, the chief conclusion of clinical value is that the positive healing of skin transplanted after the method of Thiersch is not accomplished fully till the end of a period involving several weeks or even months, and not until this time has elapsed is the newly-implemented skin fully resistant and as capable of withstanding trauma and disturbances of nourishment as the normal skin; and, moreover, that a better vitality is assured when the skin is planted upon the normal soft parts than when granulation or scar-tissue forms the bed upon which the grafting is done.

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#### NASSE ON THE EXTIRPATION OF THE SHOULDER, AND ITS VALUE IN THE TREATMENT OF SARCOMA OF THE HUMERUS.<sup>1</sup>

THE amputation of the arm, together with the scapula and a portion of the clavicle, was first performed by Cuming in 1808. It was

<sup>1</sup> Dr. D. Nasse: Berlin, Sammlung klinischer Vorträge, No. 86.

next accomplished in 1836, but since that time the number of such operations has steadily increased. Adelman succeeded in 1888 in collecting the histories of sixty-seven cases. At the present time the operation is done much more frequently, but all cases are not immediately reported. This is due to the fact that while the first cases were regarded as miracles of surgery, to-day the cure after the operation is taken as a matter of course.

The methods of operation are very numerous, and are subject to constant changes and variations. The mode of amputation or of disarticulation of different portions of the body are, however, becoming more and more uniform in the hands of the best surgeons, and this operation is no exception to the general rule. The method here described is the one employed at Von Bergmann's clinic, and is the one usually adopted.

The operation begins with the typical ligation of the subclavian artery, just exterior to the *musculus scalenus anticus*. The clavicle is then sawed through at a point corresponding to the place of ligation. This permits the arm to be elevated, and the vena subclavia is ligated, and the plexus brachialis is divided. In order to facilitate these manipulations the skin incision for the ligation should be made longer than usual, and curved towards the acromial process along the clavicle, and the skin-flap thus formed should be dissected up from the bone.

The line of incision is next extended from the outer end of the primary incision downward across the axilla, and then curved backward as far as the inferior angle of the scapula. The *musculi pectorales* are then divided, and the shoulder thus freed can be drawn backward, allowing the scapula to be separated from the thorax as far as the scapular insertion of the *musculus serratus anticus major*. The *musculus latissimus dorsi* is then divided, thus freeing the point of the scapula. If this mode of incision be followed out the loss of blood is slight. Such hæmorrhage as occurs is easily controlled by hæmostatic forceps; a mass of gauze is placed beneath the scapula, which is then drawn back to its normal position. The dorsal inci-

sion is then made as follows: beginning at the outer end of the primary incision the line of incision is carried directly downward until it meets the ventral incision at the angle of the scapula. The dorsal skin-flap is then dissected up, the musculus cucullaris is divided, the cephalic and vertebral borders of the scapula exposed, and the muscles which are inserted along these borders are divided. With the division of the musculus serratus anticus major, the amputation of the limb is complete. Some slight hæmorrhage will usually occur from the arteria transversa scapulæ and arteria transversæ colli and their branches. Both vessels are easily controlled.

After the completion of the operation, the two flaps usually need to be trimmed somewhat in order to secure a smooth wound, free from pockets or inequalities. If the necessities of the case require that the dorsal flap must be left rather large, it is best that an opening for drainage should be made.

In the final preparation of the flaps care must be taken that no muscles should be allowed to remain whose blood-supply has been cut off. All the scapulo-humeral muscles as well as the musculus deltoideus are to be completely removed. On the other hand it is better to have both flaps as thick as possible. In a sarcoma of the scapula, for example, the muscoli pectorales and latissimus dorsi may be allowed to form a part of the ventral flap; or in a sarcoma of the humerus which has not involved the scapula, the musculus trapezius should be left in the dorsal flap. By this means a thicker and better-nourished flap is secured, while if only the skin is left gangrene may result. Extensive gangrene of the flaps is unusual, however.

It is better that the vena subclavia should be ligated immediately after the artery, for the reason that the danger of entrance of air into the vein, should it be accidentally wounded during the operation, is avoided; there is also danger that during the manipulation of the tumor-mass some of the tumor-cells may be dislodged, which, were this avenue of escape still open, might readily enter into the circulation, and form metastases.

The ligation of the clavicular vessels as a preliminary step and

the formation of a dorsal and a ventral flap are the essentials of the operation. The remaining details may be modified to suit the particular case.

Although the operation seems so difficult and dangerous, as a rule, it is well borne. It has been performed by Von Bergmann in his clinic and in his private practice, fourteen times during the past few years, for various indications. But one patient has died as a result of the operation; in this case, on account of the involvement of the great vessels in the sarcomatous mass, and consequent danger from fatal secondary hæmorrhage, the sternum was resected, and the vena cava itself was ligated. Death occurred soon after this was done. The case was really an inoperable one, and should not be considered in forming an estimate of the mortality of the operation. In nearly all of the other cases the wound was healed in from two to three weeks.

Although the immediate results of the operation are so encouraging, unfortunately the final results in those cases where a sarcoma of the humerus has existed are not so good.

The numerous operative procedures employed in cases of sarcomata of the long bones vary greatly in their ultimate results. There is one form of such sarcomata, however, in which the tumor can be extirpated, and that, too, very near to the tumor-mass itself, with a considerable certainty of cure. This is the encapsulated giant-celled sarcoma which occurs in the region of the epiphyses. It is difficult to formulate the histological characteristics of this form of the disease, for the presence of giant-cells cannot be regarded as typical; these same cells are also found in some of the very malignant forms of bone sarcomata. Their number and regular arrangement are, however, of some diagnostic importance. The presence of multitudes of these cells can often be decided by the peculiar brown, reddish-brown, or spleen-like appearance of the tumor upon gross section. The anatomical and clinical peculiarities of this form of tumor are of even more value in making a diagnosis than are the microscopic appearances. The growth is entirely from within the bone, and not from the peri-

osteum. They occur in the epiphyseal region, and almost never in the diaphysis of the long bones. They are, above all, distinctly encapsulated,—an important factor in estimating their benign character. As a result of their slow growth, which may cover a period of from one to ten years, the periosteum has time to continually form new bone and connective tissue; this newly-formed material is deposited in layers around the neoplasm, and thus there is usually a smooth capsule present. In the medulla of the bone, too, there is, as a rule, a sharp line of demarcation which is often composed of firm, bony tissue. Should a break occur in the capsule, the tumor does not infiltrate the soft parts, but presses upon them in a purely mechanical way. These characteristics are those of benign growths.

It must not be supposed, however, that all giant-celled sarcomata of the long bones are benign; there are also well-recognized malignant forms. These latter have, almost without exception, well-marked variations from the class just described, both in their local development and in their anatomical characteristics. In all cases, therefore, the clinical history and the anatomical relation to their surroundings must be considered, as well as the histological appearances.

We are able, as a rule, to distinguish the benign encapsulated giant-celled sarcomata from the other forms of the disease affecting the bones, and in these cases it is not necessary that the operation should be so radical. As a general thing it is sufficient to remove the tumor carefully with curette and chisel, or to resect the bone. At any rate, one should endeavor to save the limb. Nearly all modern authorities agree upon this point. Occasionally, to be sure, a recurrence is observed, but in many cases a useful limb will be retained. In Von Bergmann's clinic four such operations have been followed by good results. One patient was entirely well after three years, and three after five years; all have useful limbs.

Such operations as these in the case of encapsulated sarcomata form the bright side in the treatment of such diseases of the bone. Unfortunately the picture is reversed with all of the remaining sar-

comata. The effort has frequently been made where some one of the other varieties existed to extirpate the tumor and preserve the limb, but never with a permanent cure. In all cases a recurrence took place. We should, therefore, with this one exception, make all operations upon sarcomata of the long bones as radical as possible by an amputation at a point as far as possible from the site of the disease.

Even with amputation at a point distant from the tumor, the results are but slight. This is primarily due to the alarming frequency and early appearance of general dissemination and formation of metastases. This is explained by the well-known fact that the sarcomata are closely related to the blood-vessels and follow their course, and are especially apt to grow into the veins. This venous infiltration will often escape our observation, but in sarcomata of the bones which have involved the soft parts, it is not at all rare to find veins that are filled with the tumor-tissue. The prognosis, in such cases, as regards recurrence, is, therefore, very grave.

Early diagnosis and operation are, therefore, necessary to guard against this general dissemination. If the formation of metastases has already begun, we are powerless to check the advance of the disease. As regards the local extension and local dissemination of the disease, the chances of success are greater. The paths which the disease follows are fairly well known. Sarcomata, as long as they are surrounded by their bony or periosteal capsule, are restricted in their growth. With a rupture of the capsule the growth of neoplastic tissue increases greatly in rapidity. This rupture of the capsule occurs with especial frequency at the insertion of muscles. The tumor-cells then begin to be generally disseminated in the muscle and its interstices. This spread of the cells probably occurs through the agency of the lymph channels. At any rate, it is hard to account for the fact otherwise. The surgeon is obliged, therefore, in every operation upon osteo-sarcomata to keep well clear of the tumor. With the fast-growing malignant sarcomata of the long bones it is necessary not merely to remove the diseased bone, but also to divide

the soft parts at such a distance proximal of the tumor that all diseased musculature is completely removed. By adopting this rule as a guide, recurrence will be rare.

Recurrence is especially apt to be observed in those cases where we are not able to remove the soft parts in this radical manner. The most unfavorable conditions in this respect exist where the femur is the bone involved. Some recent statistics go to show that up to the present time no case of sarcoma of the femur, where an exarticulation has been performed, has resulted in permanent cure.

The results in operations performed for sarcoma of the humerus are more favorable. When such a neoplasm exists in this bone, we are able, even when the adjoining soft spots are extensively involved, to operate at a safe distance from the tumor, for we can amputate the scapula and the clavicle together with the arm. If, on the other hand, the muscles arising from the thorax itself are involved, we are again confronted by the impossibility of removing all of the diseased muscle. In such cases recurrences are frequent.

Twelve of the fourteen cases of Von Bergmann above referred to were operated upon for sarcoma. In half of these, where the diseased musculature was not entirely removed, a local recurrence took place. In the others, where more radical procedures were adopted, no such recurrence was observed. Such results as these emphasize the fact that the complete removal of the soft parts involved is necessary.

It has long been known that the prognosis of osteo-sarcoma became much more grave as soon as the soft parts were involved. That local recurrence after operation is very apt to occur in such cases is not the only factor in this prognosis. Of much more serious import is the fact that the veins are usually involved, and so lead to metastases. All recent and reliable statistics show plainly this latter danger. Against this vein-involvement, and against the resulting metastases, we are, as already stated, powerless. The choice of the various methods of operation, then, is to be guided solely by the likelihood of a recurrence of the disease. An early diagnosis of the condition and the early performance of an operation before the cells

are in a certain sense endowed with life are, of course, important ; but still more important is it for us to be radical in our methods when we do operate, and remove not merely those soft parts which are visibly affected, but those also which, as a rule, are the ones next to be involved in the neoplastic growth,—*i.e.*, the muscles attached to the affected bone. Should the tumor still be completely encapsulated, it may perhaps sometimes suffice to divide these muscles at a distance from the tumor. If, on the other hand, the musculature is presumably or visibly diseased, then the entire limb should be amputated at such a point that the affected muscles are without question entirely removed.

The practical application of this rule may appear to be open to considerable difference of opinion, for to follow it out leads us too often to operations of great magnitude. With carcinomata, however, a similar principle has been acted upon for some time, and with the best of results. So long, for example, as the axilla was only cleared out in those cases of mammary carcinomata where there were glands which could be felt on palpation, and so long as operators were anxious lest there should be too great a loss of substance, just so long were permanent cures rare. Since it has become the custom to thoroughly remove all the lymphatic glands in the axilla, even with the smallest carcinomata, and more recently even to remove the fasciæ and superficial layers of the pectoral muscles, the permanent cures have become much more common. Here our knowledge of the mode of extension of carcinomata, and the aids for our operative procedures which we have gained from this knowledge, has been acted upon with the best of results. Perhaps a similar benefit will result if we operate upon osteo-sarcomata with especial reference to their mode of extension.

This rule can easily be applied to sarcomata occurring in the leg and forearm, but rarely, indeed, in the larger tumors, never in sarcomata of the femur. In case the sarcomatous growth involve the humerus, we can succeed in the majority of cases if we remove the scapula and clavicle with the arm. It is for this reason, therefore, that in the treatment of this latter class of sarcomata the extirpation



of the entire shoulder is of especial importance. Just as we do not limit the clearing out of the axilla to those cases of mammary carcinomata which have evidently involved this space, so we should not remove the scapula and clavicle only in those hopeless cases in which the thoracic muscles are already involved, but in those cases as well of small tumors of the humerus as soon as they invade the upper end of the bone, or as soon as the soft parts lower down are invaded.

So far as the patients themselves are concerned, it is a matter of more or less indifference whether they possess the scapula and clavicle or not. The deformity caused by the flatness of the shoulder is easily hidden by padding. The danger of the operation is perhaps somewhat greater than in an exarticulation of the shoulder-joint, but the difference shown by our recent statistics shows this to be of little importance. We should be willing at any rate to subject the patient to somewhat more danger if we are able to assure him a much greater chance of remaining free from a recurrence of the disease.

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